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OPTICAL READING DISK DEVICE USED COMMONLY FOR MUSIC AND MAPS

[Ongaku · chizu kyouyou kougaku yomitori disuku souchi]

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Specification /1*

1. Title of the Invention

Optical Reading Disk Device Used Commonly for Music and Maps

2. Claim(s)

(1) With respect to an optical reading disk device that is used commonly for music and maps and in which a dependent optical reading disk 17 for music data and map data is utilized as a music recording medium and shared as a map recording medium for a stand-alone navigation device 45, an optical reading disk device used commonly for music and maps, characterized by being equipped with

a means which: is provided with a circuit for transmitting music data read by the optical pickup 20 to the buffer memory 54 for maps of the navigation device 45 and a circuit for transmitting the music data accumulated in the buffer memory 54 for maps to a music data reproducing part 12; divides one track of the music data track region 74 of the abovementioned disk 17 into a lower channel L, which is for recording the first half of the music data for one track, and an upper channel U, which is for recording the last half, for each sector; sets the above two channels, U and L, to either a sequential reading mode, in which the two channels, U and L, are read sequentially, or a simultaneously reading mode, in which the two channels, U and L, are read simultaneously;

a means for shifting from the sequential reading mode to the simultaneous reading mode in response to a map data request from the navigation device 45;

* Numbers in the margin indicate pagination in the foreign text.

a means for sequentially reading the music data of the two channels, U and L, and transmitting it to the music data reproducing part 12 while transmitting the music data read in the simultaneous reading mode to the buffer memory 54 for maps in the navigation device 45; and

a means for moving the optical pickup 20 to the map data track region 75 while continuing to transmit the music data to the music data reproducing part 12 after the amount of music data accumulated in the buffer memory 54 for maps has reached a predetermined amount.

3. Detailed Description of the Invention

[Field of Industrial Application]

With respect to a vehicle equipped with a music reproducing device and a stand-alone navigation device, this invention relates to an optical reading disk device used commonly for music and maps capable of securing the continuity of music reproduced based on music data as well as reading map data as needed by using an optical reading disk that contains /2 both music data and map data.

[Related Art of the Invention]

Optical reading disks formatted to suit recording media for music data have conventionally been known. Also, optical reading disks formatted to suit recording media (ROM) for computer code data have also been known.

Furthermore, to eliminate the inconvenience of using both of these types of recording media, practical applications of disks (hereafter referred to as combination disks) that are formatted to include a track region containing a music data format and a track region containing a computer code data format have started. (An example is the interactive

compact disk, so-called CD-1, indicated in "Nikkei Electronics", No.392, pp.108 - 111, April 7, 1986.)

By recording music data in the track region for music data and by recording map data in the track region for computer code data, it is possible to predict the availability of using the abovementioned dependent disk as an external recording medium that is commonly usable by both a music reproducing device and a stand-alone navigation device equipped to a vehicle.

However, when a dependent disk is shared as an external recording medium by the above devices, a problem arises in that the optical pickup shifts from the music data track region to the map data track region in order to read the necessary map data when it is necessary to read the map data during playback of the music data, causing the playback music to be discontinued until [the pickup] returns to the music data track region (which takes about 10 minutes).

[Problems that the Invention is to Solve]

In light of this, the technical aim of this invention is to supply an optical reading disk device capable of maintaining the continuity of reproduced music by: the optical pickup reading ahead the music data by the necessary amount of time before shifting to the map data track region; the read-ahead data being stored temporarily in the buffer memory for maps in the navigation device; the read-ahead data being read and reproduced from the buffer memory for maps while the optical pickup is away from the music data track region; and music data being read directly from the disk starting form the end of the read-ahead portion after the

optical pickup has returned to the track region of the music data.

[Means for Solving the Problems]

With respect to an optical reading disk device that is used commonly for music and maps and in which a dependent optical reading disk 17 for music data and map data is utilized as a music recording medium and shared as a map recording medium for a stand-alone navigation device 45, this invention is equipped with

a means which: is provided with a circuit for transmitting music data read by the optical pickup 20 to the buffer memory 54 for maps of the navigation device 45 and a circuit for transmitting the music data accumulated in the buffer memory 54 for maps to a music data reproducing part 12; divides one track of the music data track region 74 of the abovementioned disk 17 into a lower channel L, which is for recording the first half of the music data for one track, and an upper channel U, which is for recording the last half, for each sector; sets the above two channels, U and L, to either a sequential reading mode, in which the two channels, U and L, are read sequentially, or a simultaneous reading mode, in which the two channels, U and L, are read simultaneously, as the mode used by the optical pickup 20 to read music data;

a means for shifting from the sequential reading mode to the simultaneous reading mode in response to a map data request from the navigation device 45;

a means for sequentially reading the music data of the two channels, U and L, and transmitting it to the music data reproducing part 12 while transmitting the music data read in the simultaneous reading mode to the

buffer memory 54 for maps in the navigation device 45; and

a means for moving the optical pickup 20 to the map data track region 75 while continuing to transmit the music data to the music data reproducing part 12 after the amount of music data accumulated in the buffer memory 54 for maps has reached a predetermined amount.

As a result, music data stored in the buffer memory 54 for maps can be read even while the optical pickup 20 is away from the music data track region 74 for a period of time in order to read map data, and this maintains the continuity of the reproduced music. /3

[Embodiment of the Example]

To explain this invention in further detail, an embodiment will be described in the following with reference to the accompanying drawings.

The optical reading disk device 10 illustrated in Figure 1 is roughly comprised of a data reading part 11, music data reproducing part 12, code data inputting/outputting part 13, and microcomputer 14 for control. The microcomputer 14 has built inside it a control program 15 and a program 16 for controlling the reception of input data.

The data reading part 11 is comprised of a driving motor 18 for an optical reading disk 17, motor control circuit 19, optical pickup 20, pickup control mechanism 21, amplifying/demodulating circuit 22, and error correcting circuit 23. The speed of the driving motor 18 is controlled by a commonly known means based on the control program 15, and the focus and tracking of the optical pickup 20 are also controlled by a commonly known means.

The music data reproducing part 12 is comprised of an acoustic signal

buffer memory 24, DA converting circuit 25, and speaker driving amplifying circuit 26, and the left and right speaker connecting wires, 27 and 28, are connected to the abovementioned amplifying circuit 26. A connecting circuit 29 is formed between the acoustic signal buffer memory 24 and the error correcting circuit 23 so that the former is also compatible with standard optical reading disks.

The code data inputting/outputting part 13 is comprised of a synchronized detecting/error correcting circuit 30, code data buffer memory 31, output digital signal driving circuit 32, and input digital signal receiving circuit 33. An output connecting wire 34 is connected to an output digital signal driving circuit 32, and an input connecting wire 35 is connected to an input digital signal receiving circuit 33.

In the case of a dependent-type optical reading disk 17, in order to incorporate signals output from the error correcting circuit 23 into the code data buffer memory 31, a connecting circuit 36 is formed between the error correcting circuit 23 and synchronized detecting/error correcting circuit 30, a connecting circuit 37 is formed between the synchronized detecting/error correcting circuit 30 and code data buffer memory 31, and a connecting circuit 38 is formed between the code data buffer memory 31 and acoustic signal buffer memory 24. Moreover, to incorporate signals input from the input connecting wire 35, an input data connecting circuit 39 is formed between the input digital signal receiving circuit 33 and acoustic signal buffer memory 24.

Moreover, the above-described data reading part 11, music data reproducing part 12, and code data inputting/outputting part 13 are

controlled by the control program 15 and the program 16 for controlling the reception of input data, both of which are integrated with the microcomputer 14. Also, necessary circuits are formed between the microcomputer 14 and each of the above parts, 11, 12, and 13.

The navigation device 45 illustrated in Figure 2 is a stand-alone type that automatically detects the position of the corresponding vehicle and displays it on the map in a CRT display device 60. The vehicle having this device 45 mounted on it is provided with a geomagnetism sensor 46, which is for detecting the advancement direction, driving distance, and left and right turns, left and right wheel velocity sensors, 47 and 48, and left and right wheel magnetic heads, 49 and 50.

The stand-alone navigation device 45 is comprised of: circuits, 51 and 52, for amplifying the detection signals from the abovementioned sensors, 46, 47, and 48; a data processing device 53; buffer memory 54 for maps; output digital signal driving circuit 55; input digital signal receiving circuit 56; inputting switch 57; input signal receiving circuit 58, CRT driving circuit 59, and CRT display device 60. An output connecting wire 61 is connected to the abovementioned output digital signal driving device 58, and an input connecting wire 62 is connected to the input digital signal receiving circuit 56. The abovementioned data processing device 53 is integrated with a control program 63.

The abovementioned navigation device 45 is provided with: detection signal inputting circuits, 64 and 65, in the space between the amplifying circuits, 51 and 52, and the data processing device 53; a connecting circuit 69 between the output digital signal driving circuit 55 and [the data

processing device 53]; a connecting circuit 70 between the input digital signal receiving circuit 56 and [the data processing device 53]; a connecting circuit 71 between the input signal receiving circuit 58 and [the data processing device 53]; and a connecting circuit 72 between the CRT driving device 59 and [the data processing device 53].

The abovementioned output connecting wire 61 is connected to the input connecting wire 35 of the optical reading disk device 10 /4 illustrated in Figure 1, and the input connecting wire 62 is connected to the output connecting wire 34 of the same. As a result, the music data or map data input to the code data buffer memory 31 of the optical reading disk device 10 are transferred through the circuit of the code data buffer memory 31 → output digital signal driving circuit 32 → output connecting wire 34 → input connecting wire 62 of the navigation device 45 → input digital signal receiving circuit 56 → data processing device 53 → buffer memory 54 for maps, and then becomes accumulated in the buffer memory 54 for maps.

Moreover, the map data accumulated in the buffer memory 54 for maps is output to the CRT display device 60 by the control of the data processing device 53. The music data accumulated in the buffer memory 54 for maps is transmitted to the speakers, 77 and 78, by going through: the buffer memory 54 for maps → data processing device 53 → output digital signal driving circuit 55 → output connecting wire 61 → input connecting wire 35 of the optical reading disk device 10 → input digital signal receiving circuit 33 → input data connecting circuit 39 → acoustic signal buffer memory 24 → DA converting circuit 25 → speaker driving amplifying circuit

26 → left and right speaker connecting wires, 27 and 28.

Figure 3 illustrates a dependent disk 17, and this disk 17 has a lead-in region 73, music data track region 74, map data track region 75, and lead-out region 76.

Figure 4 is the format of the processing unit (one sector) of the above disk 17. One sector contains two left and right channels for 16 bits each of stereo music, and can record necessary data in each of the upper channels that is for U8 bits and in each of the lower channels that is for L8 bits. Of the 98 frames that make up each sector, a necessary number of frames are assigned to the synchronizing pattern, header, sub header, user data, and system data in that order.

In the track region 74 of the music data, each of the speakers, 77 and 78, are correlated to each of the left and right channels as illustrated in Figure 5. The music data of the first half of a track is recorded in the lower channel L of the left channel and the lower channel L of the right channel, and the music data of the last half of the track is recorded in the upper channel U of the left channel and the upper channel U of the right channel. In Figure 5 and Figure 6, the order of playback of the music data of one track is illustrated by using numbers, 1 through 72. These are divided in halves, and "1", which is at the top of the first half, and "37", which is at the top of the last half, are separately recorded in the lower and upper channels, L and U, of the same sector. The same can be said about the relationship between the first half and last half of the second sector and thereafter.

Normally, the optical pickup 20 reads the same track, m, twice, reads

1 through 36 recorded in the lower channel L the first time, and reads 37 through 72 recorded in the upper channel U the second time. After the reading of one track has been completed, [the optical pickup] shifts to the next track, m+1, and reads it by dividing it into the lower channels L and upper channels U in the same manner.

In this manner, one track is read in the order of the lower channels L and the upper channels U, and after the reading is completed, [the optical pickup] shifts to the next track and sequentially performs reading in the same manner. This mode of reading is referred to as "sequential reading mode."

If there is no map data request from the navigation device 45, the abovementioned sequential reading mode is selected, but if there is a map data request, the lower channels L and upper channels U of one track are read simultaneously in order to read ahead the music data, and after the reading has been completed, [the optical pickup] moves to the next track and performs simultaneous reading in the same manner. This mode of reading is referred to as "simultaneous reading mode."

In addition, there is also a "map data reading mode" in which the optical pickup 20 is away from the music data track region 74 in order to read the map data.

Figure 7 illustrates the relationships between the music data read by the optical pickup 20, content of the buffer memory 54 for maps, and music transmitted form the speakers, 77 and 78, in each mode. For each of the data pieces that belong to the lower channels L and upper channels U, Figure 7 illustrates, by means of arrows, the elapsed time by the

X-direction horizontal axis as well as the direction of data flow by the Y-direction vertical axis. /5

Figure 7 illustrates a model situation in which, after map data is requested during the sequential reading mode, [the mode] switches to the simultaneous reading mode, map data reading mode, and then returns to the sequential reading mode in that order. Figure 8 is the flowchart for the control program 16 for input data reception that executes such control.

Figure 7 will be explained with reference to the flowchart of Figure 8.

In the sequential reading mode, the optical pickup 20 reads the lower channels and upper channels U of the track m in that order, and transmits the read data to the speakers, 77 and 78, via a code data buffer memory 31 as well as the acoustic signal buffer memory 24. As a result, Hi-Fi stereo music becomes played back (steps, (1) and (2), of the flowchart).

If a map data request is transmitted from the navigation device 45, the mode shifts to the simultaneous reading mode (steps, (3) and (4)), in which the lower channels L and upper channels U are read simultaneously. The read music data is sent from the code data buffer memory 31 to the buffer memory 54 for maps inside the navigation device 45 where it becomes accumulated (step (5)). Moreover, music data is read from the buffer memory 54 by means of a first-in first-out technique, sent to the acoustic signal buffer memory 24 via the input data connecting circuit 39 of the optical reading disk device 10, and is further transmitted to the speakers, 77 and 78 (steps, (6) and (7)).

With respect to the amount of music data accumulated in the buffer

memory 54 for maps, the amount of data read is half of the amount of data fed, and the accumulated amount increases cumulatively. When the accumulated amount reaches a predetermined amount (e.g. an amount for 10 seconds of playback), the optical pickup 20 is moved to the map data tracking region (steps, (8) and (9)). During this time, the accumulated music data is continually read from the buffer memory 54 for maps, and the playback of the music data is continued (steps, (10) and (11)). For this reason, the music playback does not become interrupted.

When the reading of the map data is completed, the optical pickup 20 is returned to the music data track region 74 while the mode is switched to the sequential reading mode, and is thus returned to the track at which the reading had been discontinued previously. By starting the reading process again, playback of music data is continued (steps, (12), (13), and (14)).

In Figure 7, the amount of music data accumulated in the buffer memory 54 for maps coincides with the time necessary to read the map data. The amount of accumulated music data must be kept from being too little in order to prevent discontinuation of the music playback. On the other hand, an amount of accumulated music data that is too large is not a problem since it can be dealt with by, for example, delaying the reading start by the optical pickup.

[Effects of the Invention]

In this manner, this invention is useful as an optical disk reading device for vehicles, ships, etc. that are equipped with devices for reproducing Hi-Fi stereo music and stand-alone navigation devices, and

is particularly effective in reading the map data while maintaining the continuity of music playback when utilizing a common external recording medium for both devices.

4. Brief Description of the Drawings

Figure 1 is a block diagram illustrating a preferable optical reading disk device of the invention. Figure 2 is a block diagram illustrating a stand-alone navigation device. Figure 3 is plan view illustrating a dependent disk. Figure 4 is a drawing for explaining the format of the dependent disk. Figure 5 is a drawing for explaining the recording location and recording order of music data in each sector. Figure 6 is a drawing for explaining the recording location and recording order of music data in each track. Figure 7 is a drawing for explaining the operation from reading to music playback. Figure 8 is a flowchart that is based on a computer program.

10 = optical reading disk device

11 = data reading part

12 = music data reproducing part

13 = code data inputting/outputting part

14 = microcomputer for control

15 = control program

16 = program for controlling the reception of input data

17 = optical reading disk

18 = driving motor

19 = motor control circuit

20 = optical pickup

21 = pickup control mechanism /6

22 = amplifying/demodulating circuit

23 = error correcting circuit

24 = acoustic signal buffer memory

25 = DA converting circuit

26 = speaker driving amplifying circuit

27 = left speaker connecting wire

28 = right speaker connecting wire

29 = connecting circuit

30 = synchronized detecting/error-correcting circuit

31 = code data buffer memory

32 = output digital signal driving circuit

33 = input digital signal receiving circuit

34 = output connecting wire

35 = input connecting wire

36 - 38 = connecting circuit

39 = input data connecting circuit

45 = navigation device

46 = geomagnetic sensor

47 = wheel velocity sensor

48 = wheel velocity sensor

49 = wheel magnetic head

50 = wheel magnetic head

51 = amplifying circuit

52 = amplifying circuit

53 = data processing device

54 = buffer memory for maps

55 = output digital signal driving circuit

56 = input digital signal receiving circuit

57 = input switch

58 = input signal receiving circuit

59 = CRT driving circuit

60 = CRT display device

61 = output connecting wire

62 = input connecting wire

63 = control program

64, 65 = detection signal inputting circuit

69 - 72 = connecting circuit

73 = lead-in region

74 = music data track region

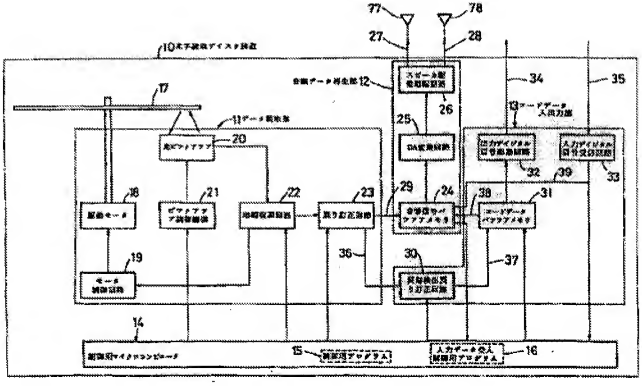
75 = map data track region

76 = lead-out region

77 = speaker

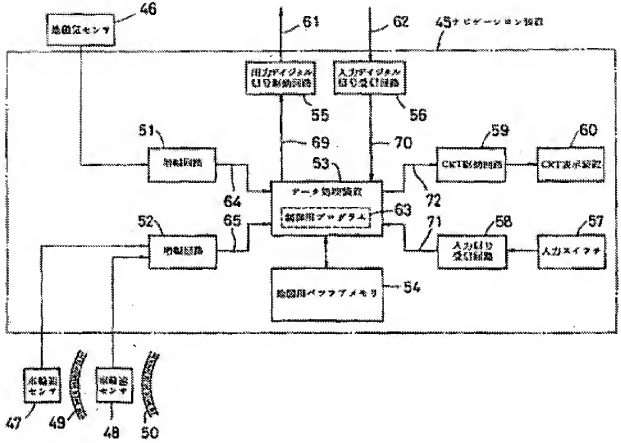
78 = speaker

Figure 1



Key: 10)optical reading disk device; 11)data reading part; 12)acoustic data reproducing part; 13)code data inputting/outputting part; 14)microcomputer for control; 15)control program; 16)program for controlling the reception of input data; 18)driving motor; 19)motor control circuit; 20)optical pickup; 21)pickup control mechanism; 22)amplifying/demodulating circuit; 23)error correcting circuit; 24)acoustic signal buffer memory; 25)DA converting circuit; 26)speaker driving amplifying circuit; 30)synchronized detecting/error-correcting circuit; 31)code data buffer memory; 32)output digital signal driving circuit; 33)input digital signal receiving circuit

Figure 2



Key: 45)navigation device; 46)geomagnetic sensor; 47)wheel velocity sensor; 48)wheel velocity sensor; 51)amplifying circuit; 52)amplifying circuit; 53)data processing device; 54)buffer memory for maps; 55)output digital signal driving circuit; 56)input digital signal receiving circuit; 57)input switch; 58)input signal receiving circuit; 59)CRT driving circuit; 60)CRT display device; 63)control program

Figure 3

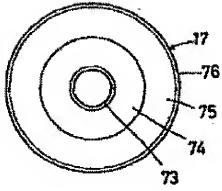
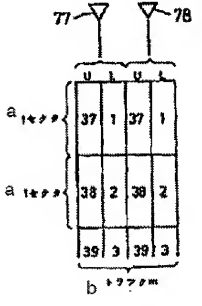
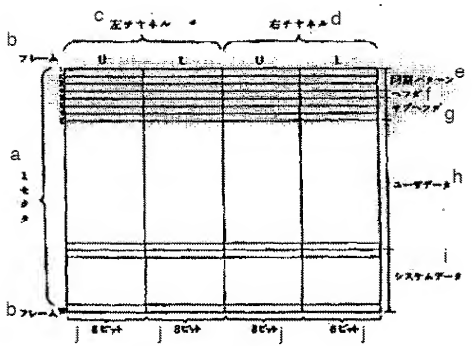


Figure 4



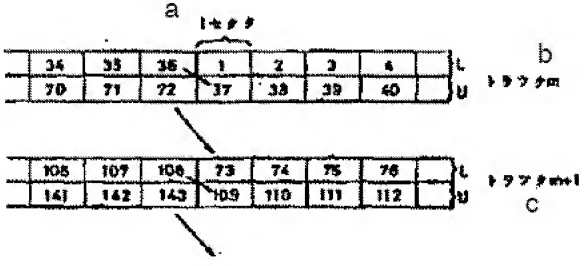
Key: a)1 sector; b)track m

Figure 5



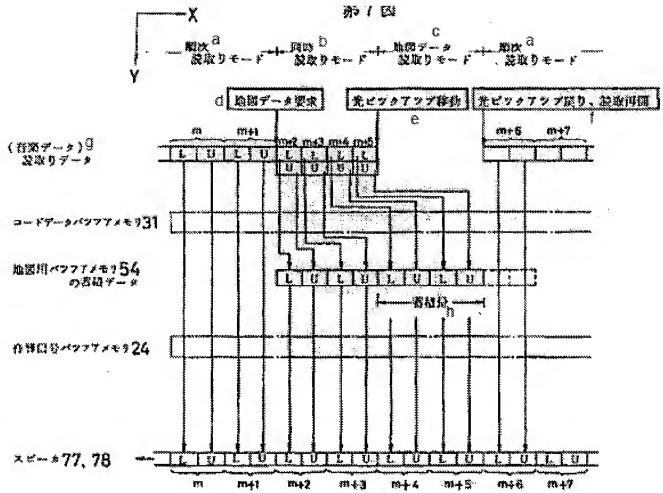
Key: a)1 sector; b)frame; c)left channel; d)right channel; e)synchronizing pattern; f)header; g)sub header; h)user data; i)system data; j)8 bits

Figure 6



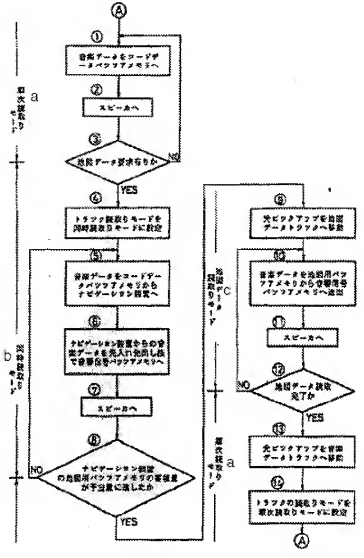
Key: a)1 sector; b)track m; c)track m+1

Figure 7



Key: a)sequential reading mode; b)simultaneous reading mode; c)map data reading mode; d)map data request; e)optical pickup shifted; f)optical pickup returned, reading resumed; g)(music data) reading data; h)accumulated amount; 24)acoustic signal buffer memory; 31)code data buffer memory; 54)accumulated data in the buffer memory for maps; 77, 78)speaker

Figure 8



Key: a)sequential reading mode; b)simultaneous reading mode; c)map data reading mode; 1)Transmit music data to the code data buffer memory.; 2)To speakers; 3)Is there a map data request?; 4)Set the track reading mode to simultaneous reading mode.; 5)Transmit music data from the code data buffer memory to the navigation device.; 6)Transmit the acoustic data from the navigation device to the acoustic signal buffer memory by first-in first-out technique.; 7)To speakers.; 8)Has the accumulated amount in the buffer memory for maps of the navigation device reached the predetermined amount?; 9)Move the optical pickup to the map data track.; 10)Transmit music data from the buffer memory for maps to the acoustic signal buffer memory.; 11)To speakers.; 12)Map data reading finished?; 13)Move the optical pickup to the music data track.; 14)Set the track reading mode to sequential reading mode